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Forest Service
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Reply To: 3420

Date: June 24, 1993

Subject: Pest Evaluation of New Sourgrass Campground (C93-7)

To: District Ranger, Calaveras Ranger District

On April 15, 1993, Sheri Smith, entomologist, and John Pronos, plant pathologist, visited the proposed Sourgrass Campground site. Also there from the SO were Brian Kermeen and Dale Buckstaff, in addition to Bob Wetzel and Kevin Locke from the Calaveras Ranger District. The objectives of our visit were to get an overview of the proposed campground site and review and provide pest management input to the campground development plans.

The proposed Sourgrass campground site is approximately 30 acres in size located along the North Fork of the Stanislaus River adjacent to Road 5N02. The overstory is predominantly ponderosa pine with California black oak, incense cedar, and a few sugar pine. The understory is mostly incense cedar with scattered sugar pine and white fir. There have been no prior vegetation management activities within the proposed site. Cut stumps are rare on the site, and the few present are assumed to have been created during fire suppression. Conifers range between 70-100 years of age with a few very old sugar and ponderosa pines. Basal areas vary between 300-400 square feet/acre in densely stocked areas.

In establishing the campground, one priority is to maintain and enhance as many of the old growth characteristics of the site as possible, and another is to attempt to restore certain areas to conditions prevalent before the turn of the century. Of particular importance is the maintenance of large black oaks and large diameter overstory conifers. The group walked along the route proposed for the main road through the campground and discussed the placement of roads, campsites and parking areas. Our intent was to utilize, wherever possible, openings, sites with dead, dying or hazardous trees and to maintain aggregations of healthy trees, particularly those with large pines and oaks.

PESTS - OBSERVATIONS AND DISCUSSION

White pine blister rust (Cronartium ribicola) was common on sugar pine regeneration. Environmental conditions along rivers and creeks such as at Sourgrass are ideal for this pathogen. The fungus will continue to eliminate most of the seedling, sapling, and pole-size sugar pines in the area. Although the few large overstory sugar pine present appeared healthy, they are probably susceptible to blister rust, but will survive because they are too large to be killed by the rust. Any future planting of sugar pine should be done using

proven rust resistant seedlings. (The biologies of all pests mentioned are described at the end of this report.)

Armillaria root disease (Armillaria spp.) was found killing pole size and smaller conifers of all species at two locations. Both locations were sites with poor drainage and wet soils. Root disease centers created by this pathogen usually originate from dead and dying oaks - healthy oaks are rarely affected by Armillaria spp. even though the fungus is present on the site. It is possible that the removal of defective living black oaks may lead to the death of nearby small, suppressed conifers. Allowing the stumps of cut oaks to sprout will reduce the likelihood of damage from Armillaria root disease.

Western dwarf mistletoe (Arceuthobium campylopodum) infections were noticed in the crowns of overstory ponderosa pines along the North Fork of the Stanislaus River. Infection was generally moderate, but occasionally severe, and although the mistletoe will probably not cause immediate pine mortality, it eventually weakens trees until they are attacked by bark beetles. Since mistletoe is present in overstory pines and there is little pine regeneration to protect, infected large trees would benefit from the removal of mistletoe. The primary benefit would be to extend the lifespan of large trees.

Forest Pest Management can provide funding for projects designed to suppress dwarf mistletoe. Projects require a proposal (form FS-3400-2) and appropriate NEPA documentation that includes project objectives, a work plan, an analysis of economic efficiency (FSM 1970 and 3422), a post-suppression evaluation plan, and a copy of this evaluation. If the District decides to pursue pest management funding, FPM personnel can provide assistance in meeting the requirements.

Ideally, a suppression project could be completed during campground construction and eliminate the need for a separate entry. However, it might be a challenge to meet suppression project requirements and deadlines in order to have the mistletoe work coincide with the silvicultural vegetation treatment. Most mistletoe suppression projects in Region 5 are done within existing facilities during seasonal closures with minimal disruption, and, therefore, it is not essential that the mistletoe work be done before the campground is completed.

Western pine beetle-(Dendroctonus brevicomis) related mortality in ponderosa pine was quite prevalent throughout the proposed campground site. Small (3-5 trees) to larger (25-30 trees) western pine beetle group kills were found along the proposed road route. Extensive breakage and blow down of these trees has created openings of various sizes throughout the stand. Current (infested trees that have not faded) mortality was limited to 5 trees evident along the proposed road. Additional mortality may be expected in densely stocked areas this spring and summer.

Western pine beetle-related mortality is frequently associated with hosts that have been predisposed by factors such as dwarf mistletoe, mechanical injury from logging or road construction, root disease, fire, and moisture stress caused by overstocking and drought. Maintaining western pine beetle mortality at acceptable levels is accomplished by preventing the development of tree and

stand conditions conducive to successful western pine beetle attack. In the case of the Sourgrass campground, prevention is best implemented through vegetation management, primarily by regulating stocking levels and species composition. In addition, reducing the effects of diseases and managing the vegetation in surrounding areas should also minimize western pine beetle damage in the campground.

Maintaining stocking densities at levels appropriate for the site is a critical factor in promoting vigorous tree growth and reducing the probability of western pine beetle-related mortality. A reduction in stocking throughout the proposed site should result in fewer western pine beetle groups kills, therefore fewer unplanned openings. In addition, increasing the proportion of non-hosts in the stand is an effective and feasible approach to reducing potential western pine beetle impacts. Selecting non-hosts as residual trees in ponderosa pine aggregations will reduce the chances of the western pine beetle killing an entire stand or aggregation resulting in large, unplanned openings. Selecting to maintain other conifer and hardwood species in aggregations of ponderosa pine is also compatible with dwarf mistletoe management.

SUGGESTED FUTURE ACTIONS

Since it is a priority to retain as many black oaks as possible and still maintain a safe environment, we began to inventory and examine all oaks and decide whether they were healthy enough to save. Almost all of the oaks contained large dead branches and were being crowded or overtopped by adjacent conifers. Some oaks were already dead. Most of the trees to be retained will require pruning to remove dead branches. FPM will continue to provide input relative to retaining the best black oaks.

The items below are suggestions or reminders of precautions that the Forest/District should consider when establishing the campground. They are intended to protect and promote tree health. Many of these points were discussed by the group.

1. Utilize methods to clearly identify important residual trees or aggregations to protect them from damage during construction and tree removal. Specifications to protect vegetation should be included in the contract with possible penalties for damaged trees. Examples of requirements could include directional felling and identifying residual trees or aggregations with flagging or fencing to minimize damage.

2. Avoid placing campsites or facilities in the seasonally wet areas. These sites are more prone to root disease and poorly developed root systems that can present safety problems.

3. Remove dying and damaged trees during the construction phase. In some cases, removal of dead tops could be effective and eliminate the need to remove entire trees.

4. If sugar pine is to be planted, use only known blister rust resistant stock.

5. Avoid planting ponderosa pine under overstory pines infected with dwarf mistletoe. Any other conifers or hardwoods would not be affected.

6. Whenever possible, reduce basal area stocking to levels that the site can easily maintain.

7. All freshly cut conifer stumps should be treated with borax to prevent the introduction of annosus root disease. (This is Regional policy.)

8. Maintain diversity in tree size. Understory trees will provide screening and replacements for the overstory in the future.

9. Consider the location of tree roots close to roads, parking areas or facility sites. Trees should be protected out to their dripline whenever possible. If roots are going to be heavily impacted, it may be better to remove the tree or choose an alternate site for the planned feature.

10. Minimize grading around residual trees to avoid damage to roots, and limit potential erosion. Keep alterations to contours that may effect the flow of surface and subsurface water to a minimum.

11. Any green slash created during the project should be promptly removed from the site or cut up for firewood to prevent the build-up of pine engravers, Ips. spp.

If there are any questions regarding this evaluation please contact Forest Pest Management at the Stanislaus Supervisor's Office (209) 532-3671.

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Enclosure

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PEST BIOLOGIES

White Pine Blister Rust

Blister rust (Cronartium ribicola) is caused by an obligate parasite that attacks sugar and western white pines and several species of Ribes. The fungus needs the two alternate hosts to survive, spending part of its life on 5-needled pines and the other on Ribes. The disease occurs throughout the range of sugar pine to the southern Sierra Nevada, but has not been reported further south. Infection of pines results in cankers on branches and main stems, branch mortality, top kill, and tree mortality.

Spores (aeciospores) produced by the fungus in the spring on pine bole or branch cankers are wind-disseminated to Ribes where they infect the leaves. Spores (urediospores) produced in orange pustules on the underside of the leaves re-infect other Ribes throughout the summer, resulting in an intensification of the rust. A telial spore stage forms on Ribes leaves in the fall. Teliospores germinate in place to produce spores (sporida) which are wind-disseminated to pines and infect current year needles. Following infection, the fungus grows from the needle into the branch and forms a canker. After 2 or 3 years, spores are produced on the cankers and are spread to Ribes to continue the cycle. Although blister rust may spread hundreds of miles from pines to Ribes, its spread from Ribes back to pines is usually limited to a few hundred feet.

Branch cankers continue to enlarge as the fungus invades additional tissues and moves toward the bole. Branch cankers within 24 inches of the bole will eventually form bole cankers. Bole cankers result in girdling and death of the tree above the canker. Cankers whose closest margins are more than 24 inches from the main bole are unlikely to reach the bole and only branch flagging will result.

Environmental conditions are critical for successful infection and limit the disease most years. Moisture and low temperatures favor infection of both hosts, and must coincide with spore dispersal for infection to occur. In California, these conditions occur only infrequently, usually in cool moist sites such as stream bottoms or around meadows. In so, called "wave years" when favorable conditions occur, high levels of infection can result. Wave years in California have occurred at approximately ten-year intervals in the past. As one moves from sites most favorable for rust to less favorable sites, the frequency of wave years decreases.

Armillaria Root Disease

Armillaria sp. is widely distributed in soils and usually lives as a saprophyte on dead wood or other organic matter. This fungus has a wide host range, including virtually all woody plants in California. It is frequently associated with hardwood roots, especially oaks. Healthy oaks are resistant to the fungus. This resistance disappears, however, when trees are weakened, stressed, cut, or killed, and Armillaria sp. may then

rapidly colonize and decompose roots and sometimes entire root systems. Stresses that have been linked to increased damage from this root disease include insect defoliation, drought, excessive soil moisture, poor planting techniques, bark beetle attack, air pollution injury, and nutrient deficiencies.

The organic material used as a source of nutrition is called a food base. With a large food base to utilize, the fungus becomes more aggressive and moves to the roots of nearby trees by means of root contacts and rhizomorphs. Rhizomorphs are structures that resemble black shoestrings and grow like roots through upper soil layers. The predominant method of tree to tree spread in California is via root contact; rhizomorphs are more important and prevalent in other areas of the country.

Armillaria sp. is capable of directly penetrating through the intact root bark of living trees and once it reaches the cambium it usually grows rapidly, producing a flat, white, leathery, fan-shaped mycelial mat. Rhizomorphs are often associated with the mat. If the fungus reaches the root collar it girdles the stem and kills the tree. After Armillaria sp. successfully colonizes a root segment or root system, it continues to decay the wood and causes a white to yellowish, wet, stringy rot. This rot does not usually extend up the stem more than a few feet above the soil line.

Clusters of mushrooms may be found in the fall at the base of infected dead or dying trees and stumps. These mushrooms may also grow directly out of the soil near the food base. Spores produced by fruiting bodies are not an important source of new infections or long distance spread.

Western Dwarf Mistletoe

Dwarf mistletoes (Arceuthobium spp.) are parasitic, flowering plants that can only survive on living conifers in the Pinaceae. They obtain most of their nutrients and all of their water and minerals from their hosts. Western dwarf mistletoe (A. campylopodum) infects principally ponderosa, Jeffrey, and knobcone pines, and occasionally Coulter and lodgepole pines.

Dwarf mistletoes spread by means of seed. In the fall the fruit ripen and fall from the aerial shoots. The seeds are forcibly discharged. The seed is covered with a sticky substance and adheres to whatever it contacts. When a seed lands in a host tree crown, it usually sticks to a needle or twig, where it remains throughout the winter. The following spring the seed germinates and penetrates the twig at the base of the needle. For the next 2-4 years, the parasite grows within the host tissues, developing a root-like system within the inner bark and outer sapwood, and causing the twig or branch to swell. Aerial shoots then develop and bear seed in another 2-4 years.

Dispersal of dwarf mistletoe seeds is limited to the distance the seeds travel after being discharged. From overstory to understory, this is usually 20 to 60 feet, but wind may carry them as far as 100 feet from the source. A rule of thumb is that the seeds can travel a horizontal distance equal to the height of the highest plant in an infected tree. There is some evidence that long

distance spread of dwarf mistletoe is occasionally vectored by birds and animals.

Vertical spread within tree crowns of most dwarf mistletoes is limited to less than one foot per year because of foliage density. Because of the thin crowns of Digger pine, however, the vertical rate of spread has been measured as being greater than 2 feet per year. This rate of spread equalled or exceeded the rate of height growth of infected trees.

Dwarf mistletoes are easy to identify because they are generally exposed to view within a tree's crown. Signs of infection include the yellow-green to orange mistletoe plants, basal cups on a branch or stem where the plants were attached, and detached plants on the ground beneath an infected tree. Symptoms include spindle-shaped branch swellings, witches' brooms in the lower crown, and bole swellings.

Western Pine Beetle

The western pine beetle, Dendroctonus brevicomis, breeds in the main bole of living ponderosa and Coulter pine larger than about 4 inches dbh. Normally it breeds in trees weakened by drought, overstocking, root disease, dwarf mistletoe or fire.

Adult beetles emerge and attack trees continuously from spring through fall. Depending on the latitude and elevation, there can be from one to four generations per year. The generations are difficult to distinguish because the prolonged period of initial attack and re-emergence of parent females to establish additional broods causes considerable overlapping of the generations.

Initial attacks are made about mid-bole and subsequent attacks fill in above and below. Pheromones released during a successful attack attract other western pine beetles. Attacking beetles may spill over onto nearby apparently healthy trees and overwhelm them by sheer numbers. Pitch tubes and red boring dust are indications of successful attacks.

Adults bore a sinuous gallery pattern in the cambium and the female lays eggs in niches along the sides. The larvae feed in the inner bark for a short distance and then turn into the outer bark to complete development.

Bluestain fungi introduced during successful attacks probably contribute to the rapid mortality associated with bark beetle attacks.

Woodpeckers, predaceous beetles and low winter temperatures cause natural control. Silvicultural activities that result in rapid, vigorous tree growth increases tree resistance and prevents mortality. Individual high value trees undergoing a temporary reversible stress, such as drought, can be protected for up to a year by applying insecticides to the bole.